

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 3 of 22

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims

1. (Currently Amended) An apparatus for use with an ion thrusting system, the apparatus comprising: an ionization membrane having at least one area through which a gas is passed, and which ionizes the gas molecules passing therethrough to form ions and electrons; and an accelerator element which accelerates the ions to form thrust.
2. (Currently Amended) The apparatus ion thrusting system of claim 1 wherein the accelerator element is a cathode.
3. (Currently Amended) The apparatus ion thrusting system of claim 1 wherein a potential applied to said ionization membrane may be reversed to thrust ions in an opposite direction.

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 4 of 22

4. (Currently Amended) The apparatus ion-thrusting system of claim 3 wherein said accelerator element is a first accelerator element which accelerates the ions to form thrust in a first direction and further comprising a second accelerator element for accelerating the ions to form thrust in a second direction.

5. (Currently Amended) The apparatus ion-thrusting system of claim 1 wherein electrons stripped from ionized gas molecules are diverted in direction substantially opposite to the flow path of the ionized molecules.

6. (Currently Amended) The apparatus ion-thrusting system of claim 1 wherein said accelerator element operates at a first polarity to cause thrust in a first direction and operates in a second polarity to cause thrust in said second direction.

7. (Canceled).

8. (Currently Amended) The apparatus ion-thrusting system of claim 1 wherein said at least one areas of said ionization membrane includes an opening in the membrane with ionizing

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 5 of 22

electrodes which are located closer than a mean free path of said gas.

9. (Currently Amended) The apparatus ion-thrusting system of claim 1 wherein the ionization membrane has one of said areas.

10. (Currently Amended) The apparatus ion-thrusting system of claim 1 wherein the ionization membrane has a plurality of said areas.

11. (Currently Amended) The apparatus ion-thrusting system of claim 1, wherein said ionization membrane comprises: an ionizing device, comprising an insulating element having at least one opening, a first conductive electrode extending on a first surface of said insulating element at the at least one opening and a second conductive electrode extending on a second surface of the insulating element at the at least one opening, wherein said insulating element separates said first and second conductive electrodes at said at least one opening by a thickness less than the mean free path of the molecules within the gas being ionized.

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 6 of 22

12. (Currently Amended) The apparatus ion-thrusting system of claim 11 wherein said first and second conductive electrodes are separated by less than 1 micron at the at least one opening.

13. (Currently Amended) The apparatus ion-thrusting system of claim 12 wherein said first and second conductive electrodes are separated by less than 300 nm at the at least one opening.

14. (Currently Amended) The apparatus ion-thrusting system of claim 13 wherein said first and second conductive electrodes are separated by less than 200 nm at the at least one opening.

15. (Currently Amended) The apparatus ion-thrusting system of claim 14 wherein said first and second conductive electrodes are separated by approximately 50 nm at the at least one opening.

16. (Currently Amended) The apparatus ion-thrusting system of claim 11 wherein the at least one opening tapers inwardly from the first surface of said insulating element to the second surface of said insulating element.

17. (Currently Amended) The apparatus ion-thrusting system of

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 7 of 22

claim 11 further comprising a substrate disposed between said first and second conductive electrodes for providing structural support.

18. (Currently Amended) The apparatus ion thrusting system of claim 11 wherein the at least one opening has a diameter approximately in the range of 2-3 microns.

19. (Currently Amended) The apparatus ion thrusting system of claim 11 wherein said first and second electrodes are formed of at least one of gold, chrome or titanium.

20. (Currently Amended) The apparatus ion thrusting system of claim 11 wherein said insulating element is formed of silicon nitride or alumina.

21. (Currently Amended) The apparatus ion thrusting system of claim 1 wherein said ionization membrane strips electrons from the ionized gas molecules and further comprises an electron accelerator to divert the electrons in substantially the same direction as the accelerated ions to maintain charge neutrality within the system.

Applicant: Frank T. Hartley
Serial No.: 10/766,230
Filed: Feb. 26, 2004
Page: 8 of 22

22. (Currently Amended) The apparatus ion-thrusting system of claim 21 wherein said electron accelerator generates an electric field and a magnetic field for linearly and rotationally accelerating the electrons.

23. (Currently Amended) The apparatus ion-thrusting system of claim 11 further comprising at least one tubular member bonded to said ionization membrane enclosing at least one of the at least one opening receiving the propellant gas and for directing the expelled ions.

24. (Currently Amended) The apparatus ion-thrusting system of claim 23 wherein said at least one tubular member is eutectically bonded to said ionization membrane.

25. (Currently Amended) The apparatus ion-thrusting system of claim 23 wherein said at least one tubular member is formed of quartz.

26. (Currently Amended) The apparatus ion-thrusting system of claim 23 further comprising a potential generation unit for